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Title: Prototype Fabrication Division Status Review

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Prototype Fabrication Division Status Review

Review Panel Final Report

June 1, 2018

1. Introduction

The Prototype Fabrication Division (PF) has a critical role in Los Alamos National Laboratory (LANL) programs as the principal provider of the complex, precision specialty components, often using exotic materials in classified configurations required for experimental activities in the Nuclear Weapons Program (NW). These experiments underpin certification of the nuclear weapons. The LANL Associate Director for Engineering Sciences commissioned an assessment of the current status of the PF enterprise with actionable recommendations for moving forward. The review was held on April 26, 2018. A panel of LANL staff with relevant experience in LANL programs and PF missions, capabilities and challenges heard presentations by PF staff and toured selected PF shops to gain first-hand updates from the floor. The excellent briefings and candid discussions amongst the briefers, workers and the panel added measurably to the effort. This report documents the observations and recommendations of the review panel.

Panel members were:

Steven Booth, AET-2
B. Pruitt Ginsberg, M-DO
Joseph Repa, J-DO
Daniel Rushton, Q-15

2. Background

From the 2006 transition until 2010, PF was organized around Main Shops, Deployed Shops and Technology Support, all under a recharge system. The recharge system proved to be unsatisfactory for the PF mission because of the high PF infrastructure burdens and uncertainty in budgeting.

LANL Group AET-2, Process Modeling and Analysis, had collected data and conducted analysis in 2003-2004 for a shops consolidation effort, and they were requested to perform an updated capability assessment and decision analysis in 2006-2007. The prime motivator for this analysis was improved capability and resource management across the LANL shops. This thorough study and analysis contributed to shop consolidation and division reorganization in the early 2010s. One result of this action was that inspection was brought back into PF.

An independent assessment conducted in 2010 by an external fabrication management consultant (FMA, Int'l) provided additional recommendations for operational efficiencies and management processes. Subsequent actions on these recommendations by PF Division have resulted in notable improvements in capabilities and business practices.

A PF funding shortfall in 2013 drove further reorganization and led to a stronger partnership with the NW program. Key changes were addition of core capability funding for the Main Shops and a recharge model for deployed shops, which improved stability of the enterprise.

PF underwent another major reorganization in 2014, simplifying its management structure, increasing focus on improving morale and operations, and on seeking customer input. Concurrently, a new funding and cost model was developed with NW that incorporated support for infrastructure and classified operations.

PF Division now operates with two operating groups, under two cost models. Weapons Fabrication Services (PF-WFS) are direct funded with capability and touch labor budgets. Laboratory Fabrication Services (PF-LFS) use a recharge business model with an hourly labor rate set to cover overhead support and future investments. In operation, the two groups are mutually supportive.

3. Observations and Recommendations

The three types of resources relied upon by PF Division are infrastructure (machines, equipment and facilities), enterprise management practices and processes, and human resources. The following observations and recommendations are presented in these three categories. In the aggregate, exceptional progress has been made in each of the categories within the past few years. Much of this progress is a result of the funding and cost model negotiated with NW, the principal PF customer, and the commitment of PF management and staff to excel at their mission.

The panel wishes to highlight several areas for exceptional progress:

- Acquisition and utilization of modern machine tools
- Implementation of modern enterprise resource management tools
- Significant advancements in metrology and dimensional inspection
- Improvements in employee morale
- Revitalization of the Machinist Pipeline Program

Infrastructure

A significant challenge for the PF enterprise is that much of the infrastructure is aged, difficult to maintain, expensive to modernize to meet current requirements, and not conducive to attracting or retaining staff. A large recent investment in new machines and equipment has added significantly to PF's capabilities. Impressive progress has been made in acquiring modern machine tools and inspection equipment, and putting them in service. This results in improved quality,

productivity and safety. Plans for continuing upgrades are in place, with preferred manufacturers established as a practice.

Recommendation: A continuing methodical investment in modern machine tools and inspection equipment must remain a high priority.

The type of facilities currently used is largely out of PF's control. However, management should still pursue opportunities to provide input to prioritizing NA-50 upgrade decisions at its shops.

Healthy prototype fabrication capabilities are absolutely essential for LANL experimental programmatic activity. This includes the full complement of buildings, machines, staff and processes. Restoring and sustaining prototype fabrication capabilities will be a long term, continuous effort. It must be guided by a strategic plan encompassing all the necessary components. Planning of this type is underway for several key LANL capabilities. Prototype fabrication must undertake such planning.

Distributed versus consolidated shop facilities (or a combination, as exists today) also must be addressed via business case analyses. The PF-LFS shops (branch shops), for example the TA-22 shop that is integrated with detonator production and detonator development, and the TA-15 shop that is integrated with experimental work utilizing DARHT, are very efficient at serving their customers because of the co-location and specialization to the customer. For the working engineer, this is critical. Continue to build on this premise.

Recommendation: Engage the institution in planning for modernizing or replacing key facilities to provide sustainability into the future.

Practices and Processes

PF Division has implemented numerous significant improvements in its practices and processes. Selected examples are:

- Implemented numerous production control, quality and productivity improvements
- The successful move to and use of JobBOSS software to schedule jobs
- Increased management presence on the shop floor
- Managers implemented an open door policy for staff
- Transferred ownership and maintenance of the secure LAN to XIT
- Assigning a manufacturing engineer to each hydro
- Initiatives on Models-Based Engineering, Advanced Manufacturing and Expanding Customer Base

- Initiated study and evaluation of advanced manufacturing
- Coordinating closely with the ADW Integrated Schedule
- General cleanup within and around shop areas

The panel offers some specific topics for further consideration:

- Train System and Test Engineers at a detailed level on PF capabilities and operations
- Open a “Quick Turn-Around” shop where time vs. cost is the value proposition
- Get the uncleared Q & W employees to rotate through the Dimensional Inspection Training Lab
- Partner with LLNL to learn their processes for things such as rounding rings to assess whether this is a better process
- Consider building stronger public/private partnerships with key machine tool and inspection platform providers to influence private developments
- Machining shells of exotic material to very small tolerances is still time consuming. Continue to explore methods and train additional machinists in this skill

Recommendation: Continuous quality improvement is becoming a foundational element of PF practices and processes. This must continue.

The goal of the PF Division is to provide a machining capability for the Laboratory that is sustainable into the future. To do this, both fixed and variable costs need to be covered for the long term. Consideration of appropriate cost recovery models could be useful.

There are several market conditions that must be handled by the business model. First, the weapons programs have committed to providing funding to sustain a core capability in the PF-WFS group. The model must provide excellent quality at a reasonable price and schedule to maintain the satisfaction of this client. A good forecast of weapon program needs would be useful to help PF predict appropriate staffing, facility, and equipment resources to sustain capability. Note that these resources can require years (or decades in the case of facilities) to obtain. Second, PF-WFS also faces periodic “walk-in” weapons jobs that have high priority and are unpredictable. A sound policy is needed to understand how to meld the core and walk-in clients so as to provide a steady, sustainable income for PF-WFS to justify investments in equipment and staff.

The PF-LFS group is fully reliant on the recharge system and has a wide variety of clients. It also is housed in multiple machine shops that are typically located close to key clients. This type of funding is much less reliable than the cost-customer model used by PF-WFS, so it is appropriate that a different business model is used.

Recommendation: A clear understanding of fixed and variable costs is needed in order to set accurate recharge rates and funding needs. An appropriate business model should be chosen and implemented to provide long-term PF Division viability.

The Liaison Office in PF-WFS has demonstrated its importance to provide a good experience for PF customers. Responsive, customer-centric service has successfully built a steady clientele, characterized by repeat customers and an expanding market. A key facet of this success that should be built upon is the education of customers—a well-educated customer is a good customer. This includes providing clients with the types and costs of various services, along with guidance to select the best option for each occasion. Example areas where customers may need help are in ML category vs. cost, how to use the job submittal process, and making sure quality drawings are obtained before work commences. Although the PF-LFS group does not have a formal liaison office, the working relationship developed between machinists and customers has essentially duplicated its success.

Recommendation: The liaison efforts to develop good customers should be emphasized.

PF-LFS is currently tracking productivity using Billable Hours as a percentage of Total Hours. This is a useful metric especially to understand financial performance under the recharge business model. The potential to grow the group by pursuing additional customers may exist; marketing is not a priority at present.

Recommendation: Additional metrics of productivity from industry best practices should be considered so that PF-LFS can understand if there is sufficient unused operational capacity to allow growth in clientele. Also, better metrics for quality beyond the total number of NCRs are needed for both groups.

A large recent investment in new machines has added significantly to PF's capabilities. Presently, machine maintenance is minimal due to a reduction in team size and the use of the same team for removal of salvaged equipment and installation of new replacements. Since replacement equipment is critical for optimal performance and replacements will continue, the team must be restored to previous levels. In doing so, a proposal should be to assign maintenance of PF-WFS as well as PF-LFS equipment to this team. This must be done soon to avoid damage to the high precision machining centers recently purchased. Continue the work being done for J-Division HE machining maintenance for machines that are similar to what PF already owns. This should also be considered for Inspection, esp. since PF manages the core function. This could be a service to others here at LANL.

Recommendation: Steady funding for preventative maintenance to keep machines in top condition must be allocated, especially Tier 1 maintenance for all new machines.

Human Resources

The type and number of staff is critical for long-term PF Division viability. Notable successes are improvement in overall employee morale and the revitalization of the apprentice program under the Machinist Pipeline Program (MPP). The future type of production (R&D versus routine/repetitive tasks) is a key factor in deciding whether a master/journeyman machinist is needed rather than a junior technician or operator. This same type of decision is needed for PF inspectors. The forecasting of expected work that is done as part of the Business Model task above will provide important data for long-term staffing decisions.

The United States job market is currently extremely tight, with a scarcity of labor that is especially acute in rural areas and small towns such as Los Alamos and Northern New Mexico. In addition, the Laboratory itself has shortages in staff that often leads to competition among divisions. This climate means PF Division must diligently develop its staff to sustain its long-term capability. Division management will need to “defend” its staff and address any salary disparities aggressively.

Recommendation: The substantial level of training needed to qualify a journeyman machinist combined with the time delay to obtain a security clearance means that there should be a “preventative maintenance” program to sustain and nurture PF staff to prevent any loss of critical people. This might include education on the importance of the work, e.g., hydros; regular training; promotion; and careful salary management.